



ARTIFICIAL INTELLIGENCE IN SUSTAINABLE URBAN DEVELOPMENT: EVALUATING CONTRIBUTIONS TO SDG-11

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ABSTRACT

The growing application of Artificial Intelligence (AI) is playing a crucial role in advancing Sustainable Development Goal 11 (SDG-11): Sustainable Cities and Communities. This paper examines the impact of AI on SDG-11, with a focus on its environmental, economic, and societal effects. A review of existing literature suggests that AI has contributed significantly to sustainable progress, but this paper critically analyzes its true implications for people's lifestyles. The discussion highlights both the positive and negative aspects of AI utilization in the context of sustainability. Furthermore, it emphasizes the need for ongoing research to explore the exact applications of AI in achieving SDG-11. The conclusion stresses the importance of effective monitoring and regulation of AI systems to ensure their alignment with sustainability goals. To achieve SDG-11 successfully, future generations must continue to develop AI models and conduct in-depth research to drive further technological advancements, ultimately contributing to a brighter and more sustainable future.

KEYWORDS: Artificial Intelligence (AI), Sustainable Development Goals (SDG-11), Urban Sustainability, Environmental Impact, Smart Cities, Economic Stability

INTRODUCTION

Artificial Intelligence (AI) is finding more and more applications in this technologically advanced, fast-paced environment. One of the key drivers to saving our planet and achieving sustainability is the optimum utilisation of AI. AI is considered a key driver in advancing the United Nations' Sustainable Development Goals (SDGs). Specifically, its utilization has been crucial in accomplishing SDG-11: Sustainable Cities and Communities¹.

The impact of AI on SDG-11, however, presents a complex picture. Research utilizing data from sources such as the AIxSDG Database and the Community Research and Development Information Service (CORDIS) indicates a regional bias, with European nations leveraging AI more extensively than other regions. This uneven distribution of AI usage is expected to positively influence sustainable development in these countries. Additionally, a study published in Nature Communications offers a more nuanced perspective, recognizing both the potential benefits and drawbacks of AI in achieving SDGs. While AI has shown promise in supporting sustainable cities, its effectiveness remains contested due to a lack of comprehensive longitudinal studies. This underscores the need for further global research to assess the long-term effects of AI on SDG-11 and its overall sustainability impact.

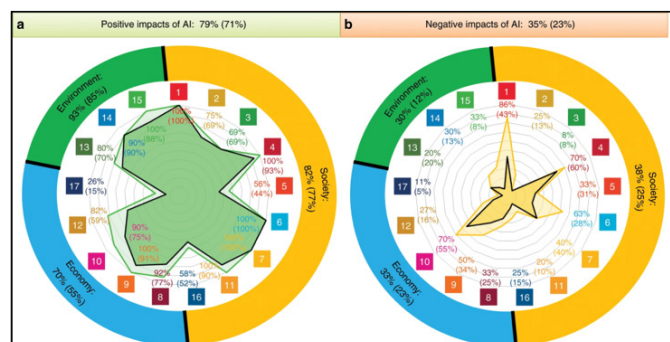
METHODOLOGY

This study uses a secondary qualitative methodology to analyze the role of artificial intelligence (AI) in advancing Sustainable Development Goal 11 (SDG-11) for sustainable cities and communities. By reviewing existing literature, reports, and case studies, the study examines both the positive and negative

impacts of AI on urban sustainability efforts, including housing, environmental management, and economic stability. This approach effectively explores multiple perspectives on AI's contribution to SDG-11 without primary data collection. However, limitations include a reliance on pre-existing sources, which may not fully capture emerging developments in AI applications for urban sustainability.

Analysis and Assessment

Through assessing the real-world impacts of AI systems, it was found that targets like 11.1 (safe and affordable housing) and 11.4 (protection of the world's natural and cultural heritage) have been positively impacted from both a social and economic standpoint. Different applications of AI working toward the common goal of sustainability have helped strengthen key societal aspects, including, but not limited to, sewage disposal, waste management, and air quality.



Source: Vinusa et al. (2020)

Fig. 1: Summary of AI's positive and negative impact on the various SDGs.

According to Fig. 1a, AI systems have been successfully implemented across 100% of the targets linked to SDG11, with 90% of the systems positively contributing to improving living standards and the quality of life through sustainable living. However, despite these benefits, 20% of the SDG11 targets have been negatively affected by AI, with 10% of these leading to harm to society, the economy, and the environment (as shown in Fig. 1b). This highlights AI's pivotal role in driving progress toward SDG11 (Sustainable Cities and Communities), but also its mixed effects.

Societal Impact

Positives

AI has a vast impact on society, particularly in improving the efficiency and accessibility of safe housing, robust transport systems, and green public spaces. By analyzing societal engagement, AI tools can better address rising concerns and adapt urbanization processes to enhance sustainability. AI enables significant contributions to urban development, making it a key enabler for achieving SDG11.

Negatives

Despite its advantages, AI's implementation has led to several societal challenges. The constant push for sustainable practices can negatively impact the overall quality of life and living standards within urban areas. Moreover, AI can be misused to breach privacy and security, creating confusion and societal unrest, particularly when AI systems fail to align with public expectations.

Environmental Impact

Positives

AI has been effectively applied in environmental control and disaster management. Through AI systems designed for air pollution analysis, scientists can now implement cost-effective and sustainable measures to combat greenhouse gas emissions. Additionally, AI's role in predicting natural disasters has proven invaluable in mitigating potential damage to infrastructure, roads, and ecosystems, significantly contributing to SDG11's environmental goals.

Negatives

Despite its potential benefits, AI can inadvertently cause environmental harm. Large AI systems that analyze weather conditions or waste management often require vast physical infrastructures, leading to deforestation, resource depletion, and habitat destruction. To mitigate these impacts, AI applications must prioritize minimizing environmental disruption, focusing on virtual data analysis instead of extensive physical infrastructure.

Economic Impact

Positives

Economically, AI has contributed significantly to the achievement of SDG11 by improving resource allocation for sustainable urban growth. Countries investing in AI technologies for safe housing, clean drinking water, and renewable energy have seen long-term benefits that enhance macroeconomic stability. AI's applications in urban planning

and infrastructure management ensure efficient resource use, leading to more sustainable economic outcomes.

Negatives

However, the costs associated with implementing AI for sustainable development can be burdensome. The high expenses related to AI processes, such as in clean water supply, may result in increased costs for consumers. Moreover, the uncertainty surrounding AI's long-term effects poses challenges for economists, who struggle to predict the future of AI's economic implications within sustainable practices.

Research Gaps in AI Regarding SDGs

AI is still a relatively new tool in advancing SDGs, and many research gaps persist, especially regarding its drawbacks and the risks of implementing AI systems for sustainability. More comprehensive data evaluation is necessary to determine the long-term viability of AI-driven solutions for SDG11. One significant gap is assessing cities' ability to adapt to climate change impacts, requiring better-informed policies and up-to-date methodologies. Furthermore, rigorous experimental testing and data-backed research are essential to ensure AI's effectiveness in sustainable development efforts.

CONCLUSION

In conclusion, Artificial Intelligence (AI) is playing an increasingly pivotal role in advancing several Sustainable Development Goals (SDGs), particularly SDG11: Sustainable Cities and Communities. The application of AI has shown significant improvements in social, environmental, and economic aspects, particularly through its contributions to waste management, pollution control, housing, disaster monitoring, and addressing urban infrastructure challenges. AI's implementation has led to enhanced quality of life for many, but its use requires careful monitoring to ensure sustainable and effective outcomes. While AI is actively supporting the achievement of SDG11 targets (11.1–11.9), research gaps remain that hinder a full understanding of its long-term effectiveness. Further studies are needed to address these gaps and refine AI applications, which will ultimately help drive SDG11 and the other SDGs forward, ensuring progress by 2030.

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